Cycles in the Universe

Juergen Eibisch

Contents

1 A Look back

Ptolemy's geocentric worldview dominated the imaginations of the macrocosm for a long time. Later, the Copernican heliocentric worldview became established.
The ancient Greeks preferred as their worldview the imagination of four elements: fire, air, water and earth.
Democritus defined with his theoretical approach the atoms (atomos = indivisible).
This theory achieved increasing importance with Dalton in the 19th century.
The scientific findings and approaches since the 20th century led to an inseparable view of macrocosm and microcosm.
When speaking of all scientists, Max Planck and Albert Einstein deserve special mention.
The limits of the microcosm is defined by Planck time and Planck length.
Shorter times and lengths can not be experienced. The experiential limit of the cosmos is the cosmic background radiation.
Einstein defined the velocity of light as constant.

2 Planck and Einstein

The experiential states of space and time as space-time are mathematically represented with the help of the definitions of Planck time t_P and Planck length l_P by the natural constants:

Planck's constant h,
Velocity of light c,
Gravitational constant G.
For representing energy it is favorable to use a wave-like motion, since energy and mass are proportional to each other, after Einstein's famous formula E = m c^2 with c^2 as constant of proportionality. A wave is a periodic change of state along a line, either transversally or longitudinally. In reaching again the initial state of the wave, a period of the wave is described (Surface integral = 0). The wave should be understood here as electromagnetic wave.

2.1 Planck time

The smallest possible period of time is the Planck time, which follows from
$t_P{}^2 = \hbar G c^{-5}$ and yields to t_P = 5.39121 x 10^{-44} s.

2.2 Planck length

The Planck length l_P describes the distance, travelled by a wave period during the Planck time t_P= 5.39121 x 10^{-44} s with the velocity of light c, its value is l_P = 1.61624 x 10^{-35}m.

2.3 Planck mass

The Planck mass m_P is defined as SI equivalent with m_P= 2.17645 x 10^{-8} kg. That is a surprisingly high value since it was measurable with conventional laboratory technology. If the mass is represented as quantized electromagnetic wave in the shape of a rotating spherical wave with internal torsion (Moebius strip), it is consistent with the interpretation of gravity after Higgs.
An electromagnetic wave without internal torsion (Moebius strip) does not contribute to gravity, i.e. particles or fields with rest mass Null do not contribute to gravity.

From the definition of the Planck world follows the constancy of Planck's constant h, the velocity of light c, and the gravitational constant G. The description of the space-time is thereby consistent, i.e. closed in itself.

3 Macrocosm and Microcosm

The implausible model of a hot Big Bang obviously displays that the epochal results of Planck's and Einstein's thinking does not protect against misinterpretations. The Big Bang does not account for neither the primal state of the universe nor where the created matter does expand; furthermore it does not provide a plausible process scenario.
The initial conditions of the cosmos are hypothetical; i.e. they can be interpreted differently. From Hubble's discovery that the cosmos is expanding in time, as had been inferred, going backwards in time, that at the beginning the state of the cosmos was concentrated in one single point.
The causality starts after Planck with the Planck length l_P and the Planck time t_P .
This approach can mislead in a retro view to the conclusion that the whole now existing cosmos 10^{-44} seconds after the Big Bang had had a perimeter of one centimeter. However, this would be imaginable only with an energy that is equivalent to an unimaginable temperature of millions Kelvin.
Actually, there is an insurmountable limit, the Planck time t_P = 5.4 x 10^{-44} s, below that, no physical reality can be described. The same is valid for the Planck length l_P= 1.61624 x 10^{-35} m in connection with the velocity of light.
Dark energy and dark matter play a computational role in the current cosmology as compensation to an equilibrium, but they are not detectable.
It becomes more and more obvious that every galaxy includes a black hole in its center. It is conceivable that the physical state of the black holes is equivalent to the initial state, i.e. a coherent energy state, of the universe.
The reactions of the matter in a black hole involve, of course, higher temperatures than the creation of matter in the reaction layer of the cosmos out of the initial state of the universe by nucleation.
Based on the defined premises of the Planck world and the solid observations of the cosmic background radiation, it is possible to construct a new model with the help of existing physical laws without a hot Big Bang, namely the development of the cosmos out of the universe according to the model of nucleation.

3.1 Basic Theses

There was and there is an original state of the universe without any start that is a state of coherent energy.
For describing this original state of the universe, physical models that are verifiable experimentally do not exist.
The space-time is available only to the limits of the Planck world. The initial state with its coherent energy can be assumed as inversion, namely as non-space-time with sub-Planck entities. With the beginning of the materialization, the known laws of nature are valid.
It should be differentiated between the physical models and the mathematical approaches because mathematics is just the formal language of physics.
The physical model should always have the priority. The basis of all considerations on physical systems is Gödel's incompleteness theorem: "Every sufficiently complex formal system is either contradictory or incomplete".
Wherever in mathematical descriptions the value zero appears, it has to be checked whether this can be physically plausible (singularity).

3.2 Our Space-time in the Planck World

The space-time is described in four dimensions

x axis as length
y axis as breadth
z axis as height
t axis as time

The space-time becomes existent as soon as there is matter. The limits are described by the Planck world:
t_P Planck time
l_P Planck length
m_P Planck mass

Max Planck defined the relation with the help of Planck's constant h, the velocity of light c, and the gravitational constant G:

$t_P{}^2 = \hbar\ G\ c^{-5}$
$l_P{}^2 = \hbar\ G\ c^{-3}$
$m_P{}^2 = \hbar\ G^{-1}\ c$

The squares of time, length, and mass are in essence directed momentums, which can not be smaller than zero. Directed quantities are vectors. They become by squaring scalars, which can be understood as probabilities. Scalars respectively probabilities must not become smaller than zero.
Time is defined as a complete period of an oscillation with Planck length l_P in the Planck time t_P.
The Planck mass m_P should not be understood as definition of the mass of an elementary particle but it is the minimal limit of the mass of a nucleus capable of development if the formation of the cosmos by nucleation is assumed.
Assuming the emergence of the cosmos by nucleation, it follows the constancy of G from the moment of de-coherence of the coherent energy respectively the transformation of sub-Planck entities to matter. As soon as the critical mass m_P is reached, the formation of matter has been constituted and it applies $m_P{}^2 = \hbar\ G^{-1}$ c.
G appears as part of the triad of the constants h, G, c.
A projection from physical parameters as time, length, mass and from them is derived the parameter of the world of matter back to the world of coherent energy. Respectively, sub-Planck entities are not possible because any verifiable physical model for the world of coherent energy, respectively sub-Planck entities, do not exist.

3.3 What is Mass?

Mass can be represented as a quantized electromagnetic wave in the form of a rotating spherical wave with angular momentum and torsion. Inside of a single electromagnetic spherical wave, multiple inner torsion (Moebius strip) are imaginable.
Elementary particles with rest mass >0 MeV have the property of mass.

4 Elementary Particles

When looking for elementary particles forming the basis of the microcosm, one is confronted with the so called particle zoo. Which criteria are necessary to single out from that diversity the indivisible but necessary particles?
In a recent paper by Lemmer [11, p.135] 16 particles were declared as elementary particles. Following Caesar [7] we have to understand the linear electromagnetic wave and the spherical wave as an elementary phenomenon. The concepts particle and wave are synonyms according to Einstein's formula $E = m c^2$.
Arranged according to the rest mass we have:

Kind of particle	rest mass (MeV)
Photon γ	0
Neutrino v	<0.0001
Electron e	0.5
Quarks u-q	2
Quarks d-q	5

Do these particles, out of the entirety of the elementary particles, suffice for the construction of the macrocosm with all its complex interactions in our world?

4.1 Photon

The photon γ, as a linear particle, is considered in the Planck world as a wave period, used for the definition of the smallest possible distance, the Planck length t_P . This can be travelled in the smallest possible time, the Planck time t_P, with the velocity of light c. The photon is understood as linear electromagnetic wave with rest mass 0 MeV. Therefore it does not contribute to the mass of the cosmos.

4.2 Additional Particles as Spherical Waves

All further particles are based, according to Caesar [7], on the conception of spherical waves with different characteristics, which implicate mass, charge, and gravitation.

4.2.1 Neutrinos

The neutrino v appears, according to Lemmer [11] and Mjakischew [12], in 6 kinds: electron neutrino, muon neutrino, tau neutrino and their antiparticles.
The neutrino is stable, nearly massless (rest mass < 0.0001 MeV) and with a charge zero. According to Caesar [7] the neutrino can be represented as spherical wave, where the form of the sphere without inner torsion leads to a very small rest mass and hence to a small contribution to mass of the cosmos.

4.2.2 Electrons

The electron e is stable and has the rest mass 0.5 MeV [1]. After Caesar [7] an additional phenomenon of the form of the spherical wave appears, namely the inner torsion of the rotating electromagnetic wave (Moebius stripe). This generates the charge, and after Higgs the mass [11]. While the charge can be explained by the different positions of the half wave during the rotation of the electromagnetic wave as Moebius stripe, the motion of the Moebius stripe leads quasi to an imbalance of the electron as spherical wave. Defining the spherical wave with torsion as Higgs particle it accounts for the existence of the mass. The decay of a Higgs particle into two photons is possible [11, p.262].

4.2.3 Quarks

The quarks q show, after Caesar [7], has the same structure as electrons do. The u-quark with 2 MeV and the d-quark with 5 MeV mass are imaginable as Moebius stripe with a single torsion, while the charm quark (c-quark) with 1275 MeV and the strange quark (s-quark) with 95 MeV are imaginable as Moebius stripe with a double torsion.
A threefold torsion is assumed for the top quark (t-quark) with 173500 MeV and the bottom quark (b-quark) with 4180 MeV. From that follows are the existence of charges.
For constructing protons and neutrons only u-quarks and d-quarks are necessary:
Proton (uud), neutron (udd). The outward appearance of protons and neutrons are imaginable as Wente-areas.

4.3 Necessary Elementary Particles

For a static view on the microcosm, the following elementary particles are sufficient:
Photon, neutrino, electron, u-quark and d-quark. Thereby the building blocks of atoms are given [13, p.914].
Representing the mass as quantized electromagnetic wave with angular momentum (torsion) mass and energy are equivalent here too.
By defining the energy term of the torsion as Higgs field, respectively Higgs particle is the mass defined. Therefore all particles with a rest mass >0 contribute to the gravity, but not photons, and neutrinos only marginally.
Not involved are the reactions between particles as oscillations of particles [11] and mutual transformations of particles [12], which are basically reversible.
The spectrum of these phenomena, their resonances and stability states, as well as their conversion and representation as particle, have led to the so called particle zoo.
These models are indispensable for the understanding of the kinematics of microcosm and macrocosm.

5 How did the Cosmos come into Existence?

Based on the now established facts

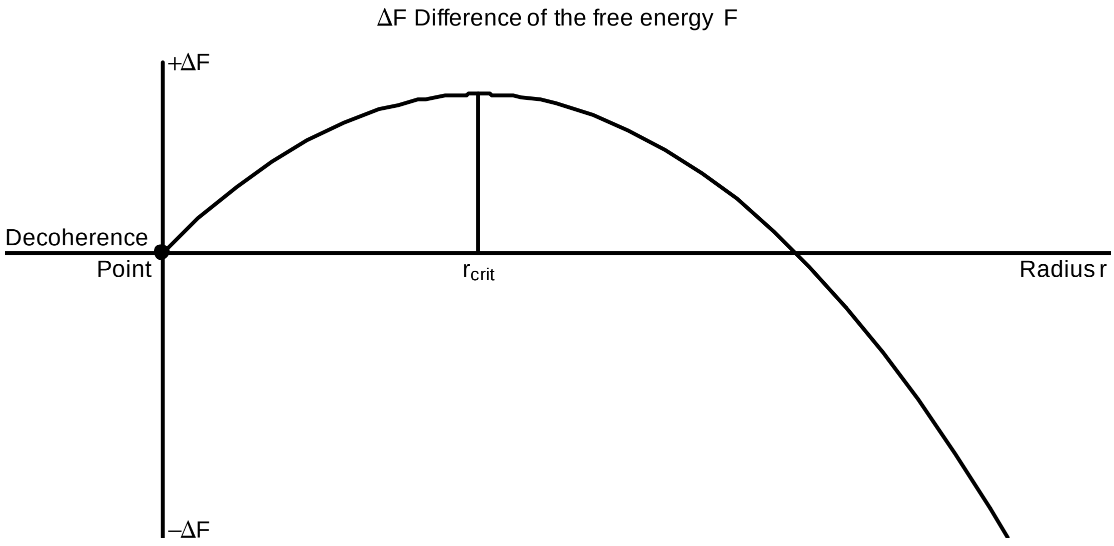
- cosmic background radiation,
- expansion of the cosmos after Hubble,
- formation of matter by de-coherence,
- Doppler effect

it is possible to formulate another plausible approach, divergent from the theory of a hot Big bang. This alternate plausible approach is the formation of the cosmos out of the universe by nucleation.
The basis of the consideration constitutes the physical fundaments and their interrelation in the sense of the Planck world.
The following basic quantities have to be brought into relationship:

Temperature T, velocity v, energy E, velocity of light c, mass m, gravitational constant G, distance l, Planck's constant h, and time t. The temperature is measured in Kelvin.
Between energy E and mass m there exist a proportionality: E ~ m. The proportionality factor c² has been introduced by Einstein. Since the velocity is defined as quotient of path l and time t (v = l/t), path and time have to be defined. The fundamental relations after Planck are derived from relations between gravitation constant, Planck's constant, and velocity of light (compare 3.2!).
In our cosmos the values can not fall below or become negative for the following quantities: Temperature T = 0, length t_P and time t_P .The greatest possible mass of a particle is defined by t_P, equal to 2.17645 x 10^{-8} kg.

5.1 Beginning of the Cosmos

The beginning of the existence of our cosmos can be defined with the help of Planck length t_P, Planck time t_P and Planck mass m_P (equivalent to Planck energy Ep). Assuming that in an infinity of coherent energy space and time respectively, space-time are not definable. In this state of the universe called non-space-time, coherent sub-Planck entities are imaginable.
The non-space-time is invariant towards geometry and time. This constellation could be explained as an infinitely black body (black hole).
At a temperature T > 0 the mobility of the sub-Planck entities is probably so great that condensation arises and sub-Planck entities locally de-cohere so that a formation of nuclei becomes possible (see figure below, and [4]).



Exceeding the point of de-coherence, the formation of matter starts according to the laws of nucleation [4, page 102]. A nucleus of matter consisting of photons, neutrinos, quarks and electrons is generated. Assuming a spherical shape of the nucleus, it must exceed the critical radius r_{crit} so that it does not decay. As soon as the change of the difference of the free energy ΔF has become negative, the nucleus does not decay anymore and will reach the Planck mass m_P .The Schwarzschild radius r_s of the Planck mass m_P amounts to 3.26 x 10^{-35} kg, which is twice as much as the Planck length l_P = 1.61624 x 10^{-35}m.
Exceeding the critical radius r_{crit} and the Planck mass m_P, the nucleus continues growing. Inside the coherent universe (non-space-time) a small sphere of matter (cosmos) has arisen and is growing.
The reaction chain can be outlined in the following way:

The sub-Planck-entities aggregate at certain mobility and agglomeration to wave packets with momentum > 0, corresponding to photons (bosons). Locally, the transition from linear to angular momentum seems to be possible, i.e. to the form of an electromagnetic rotating spherical wave. According to the resonance, neutrons, quarks and electrons arise that way. Thereby the basis of the development of protons, neutrons and, ultimately, hydrogen and helium is given, whereby the particle oscillation of the quarks leads to a dynamic equilibrium of protons and neutrons [11].

5.2 Creation of Matter in the Reaction Front

The creation of matter proceeds at a temperature between 0 K and 2.19 K (Bose-Einstein-Temperature) up to the para-helium (Para-4He). The isotope 3He is left out of consideration. The relative abundance of 4He amounts to 99.999863 % whereas that of 3He, amounts to 0.000137 % [8]. Possibly, the formation of 3He can have occurred at subsequent developments of the stars.
Para-4He at a temperature between 0 and 2.19 K is characterized by

- Chemical potential μ = 0,
- Energy state ε= 0,
- Momentum p =0,
- Spin quantum number n_s = 0.

It is not reactive [1].

The process of formation of matter will come to a standstill according to the law of mass action (LMA):

$$\frac{[\text{Product of the concentration of the end product}]}{[\text{Product of the concentration of the starting product}]} = \text{constant}$$

The temperature t_{BE} = 2.19 K is an arrest point of the phase transition of helium. A phase is the entirety of all chemically and physically common domains. The stability of the phases is dependent on pressure and temperature. The gain of energy in the formation of para-helium, however, is so high that the arrest point t_{BE} = 2.19 K is transcended and the phase transition to ortho-helium occurs. According to the constancy of the balance (after LMA) the para-helium must be produced additionally. The reaction front with the temperature t_{BE} = 2.19 K may be considered as reaction isotherm in the sense of the law of mass action [8].
The ortho-helium converted from helium 4He is available for the further development of the cosmos and explains why there exist more helium in the cosmos than expected by processes of the development of stars.

5.3 Cosmic Background Radiation

The reaction front between the non-space-time and the cosmos moves radially into the non-space-time (Expansion after Hubble). The reaction front is characterized by the Bose-Einstein temperature.
Due to the Doppler- effect, the background radiation appears as a noise floor of T ≥ 2.7 K from all directions (cosmic background radiation). The background radiation is a cavity radiation [6]. With the help of the Doppler-effect, the difference between 2.7 K - 2.19 K can calculate the parameter H. The reciprocal of this is the age of the cosmos. After Wien's law of temperature shift, the temperature of 2.19 K corresponds to the wave length of 1.323 mm, the temperature of 2.7 K to a wave length of 1.073 mm.
From this follows the Doppler shift z= 0.1889645 based on λ = 1.323 mm corresponding to a Bose-Einstein temperature of t_{BE} = 2.19 K .The radial velocity of the reaction front v_r = z * c results to 56650 km/s. The Hubble parameter H = $\frac{v_r}{t}$ amounts to 55 km/s^{-1} / mega parsec, if

the radius of the cosmos r = 1030 mega parsec is assumed. The reciprocal of this, the approximate value of the age of the cosmos, follows 17.2 x 10^9 years.
The accuracy of the Hubble parameter H depends essentially on the accuracy of the cosmos radius r, since the Bose-Einstein temperature t_{BE} and the temperature of the cosmic background radiation t_{cbr} are relatively well known. A change of the temperature of the cosmic background radiation which is observable, would influence the value of the Hubble parameter.
Our cosmos appears as space-time growing like a bubble, that annihilates after a finite period of time.

5.4 Cycles in the Universe

- Non-space-time without any information (the universe)
- Accidental compression of sub-Planck-entities (nucleation)
- Formation of matter creating the space-time (cosmos)
- Expansion of the cosmos by radial motion of the boundary layer (Hubble)
- Development of dissipative (self-organizing) structures in the cosmos
- Limitation of the life time of the cosmos to 10^{100} years, since the life time of the proton is given with 10^{31} years by Hasinger [5].
- Annihilation of matter and transition into the non-space-time.

These cycles are always possible.
According to this model, time is defined as description of the time of a complete oscillation period, it means that photons do already exist. The mass appears initially as electromagnetic spherical waves (Caesar, [7]).
The gravitation constant is constituted after the formation of mass, and remains constant although the creation of mass continues, whereas the Hubble parameter seems a change over time is possible.
Therefore, the “hot” Big bang theory is not necessary. (Unzicker, [9])
V.S. Netchitailo, [14] used an equal model to get to similar results:
“The cosmos (world) is finite and expands into the infinite universe representing an unlimited amount of energy for the creation of matter. The cosmos arose due to a fluctuation through nucleation. The further growth (creation of matter) takes place in the front of the event horizon which is identic with the cosmic background radiation.”
The cosmic background radiation is sufficiently examined and uncontroversial (absolute reference frame). Consequently, the presented model should also be in accordance with the intentions of Unzicker [10]. The computed age of the cosmos (17.2 billion years does not contradict the age (13.2 billion years) of the oldest known star (Star List no SMSS J 031300. 36 – 670839.3) in our galaxy.

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